

**BLACKSTONE RIVER BASIN
UPTON, MASSACHUSETTS**

**OLD GRIST MILL POND DAM
MA 00668**

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

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**DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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OCTOBER 1978

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ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is an earthfill embankment 90 ft. long and 24 ft. high with concrete headwall on the upstream and downstream slopes. There are deficiencies which must be corrected to assure the continued performance of this dam. Generally the dam is in good condition although the concrete on the structure is severely eroded and in poor condition. It is classified as having a significant hazard potential.		

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PHASE I INSPECTION REPORT
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PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00668

Name of Dam: Old Grist Mill Pond

Town: Upton

County and State: Worcester County, Massachusetts

Stream: Center Brook - Tributary of the Blackstone
River

Date of Inspection: August 23, 1978

Old Grist Mill Pond Dam was originally built some time prior to 1925 and was reconstructed in 1953. The dam is an earthfill embankment 90 feet long and 24 feet high with concrete headwalls on the upstream and downstream slopes. Route 140, a State Highway, is located on the crest of the dam. There is a concrete outlet structure located on the upstream face of the dam. The structure contains three weirs and a gated outlet. Two of the weirs are ungated openings, one on each sidewall of the outlet structure. The third weir serves as a spillway and consists of flashboards placed in a slot extending the full height of the outlet structure. The flashboards are 4.4 feet long. The top of the flashboards is at elevation (El) 293.3. A 4-foot high by 4.4-foot wide outlet opening is located at the bottom of the structure and is controlled by a wooden slide gate. The invert of the outlet is at El 283.0. Discharge flows through the dam in a 10-foot wide by 16-foot high concrete box culvert. Below the culvert is a stream channel about 15 feet wide with vertical stone sidewalls.

There are deficiencies which must be corrected to assure the continued performance of this dam. This

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conclusion is based upon the visual inspection at the site, the limited engineering data, and limited evidence of operational and maintenance procedures. Generally, the dam is in good condition although the concrete on the structure is severely eroded and in poor condition. Old Grist Mill Pond Dam is classified in the "significant" hazard category.

The following are visible signs of distress which indicate a potential hazard at the site: erosion and spalling of the concrete on the outlet structure; slight seepage at the top of the outlet gate; slight seepage at the toe of the dam; a small tree growing at the toe of the dam; erosion of the embankment slopes near the west abutment; accumulation of rock debris in the floor of the box culvert; and minor efflorescence, cracking and seepage in the walls of the box culvert. In addition, the channel downstream of the dam contains heavy overgrowth of trees and brush, an accumulation of rock and soil 2 feet above the floor of the box culvert, and pieces of rock fallen from the side walls.

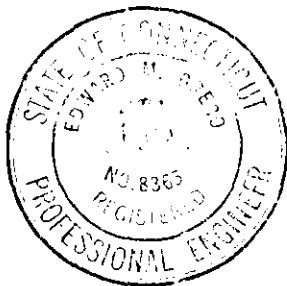
Hydraulic analyses indicate that combined flow over the flashboards and overflow weirs, and through the outlet gate would be 700 cfs when the water surface is at El 301.1 which is the lowest elevation of the crest of the dam. An outflow test flood of 2,440 cfs will overtop the main dam by a maximum of 3.6 feet. The outlet structure can only discharge 29 percent of the test flood before overtopping the dam occurs. In the event flow overtops the dam, complete failure of the dam is unlikely to occur. The highway pavement and concrete headwalls will serve to protect the dam under flood conditions. However, erosion of the dam could occur, resulting in a breach and partial failure of the dam.

It is recommended that the Owner accomplish the following: repair the concrete on the upstream and downstream faces of the outlet structure, repair leakage at the top of the outlet gate, clear trees and brush from the downstream channel, remove accumulated rock and soil from the floor of the box culvert and from the downstream channel, repair the stonework in the walls of the downstream channel, monitor the small seep at the toe of the dam, cut down the small tree at the toe of

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the dam, repair erosion of the embankment slopes near the west abutment, and repair the minor efflorescence and seepage in the walls of the box culvert. The Owner should also implement a systematic program of inspection and maintenance.

The concrete on the outlet structure should be repaired by the Owner within one year. The remaining remedial measures in Section 7 should be implemented by the Owner within a period of two years after receipt of this Phase I Inspection Report. An alternative to these recommendations would be to drain the pond and breach or remove the dam.



A handwritten signature in cursive script, reading "Edward M. Greco".

Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

Connecticut Registration
No. 08365

Approved by:

A handwritten signature in cursive script, reading "Stephen L. Bishop".

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703



OLD GRIST MILL POND DAM

This Phase I Inspection Report on Old Grist Mill Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials
Branch
Engineering Division

FRED J. RAVENS, JR., Member
Chief, Design Branch
Engineering Division

SAUL C. COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

OLD GRIST MILL POND DAM

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrology and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

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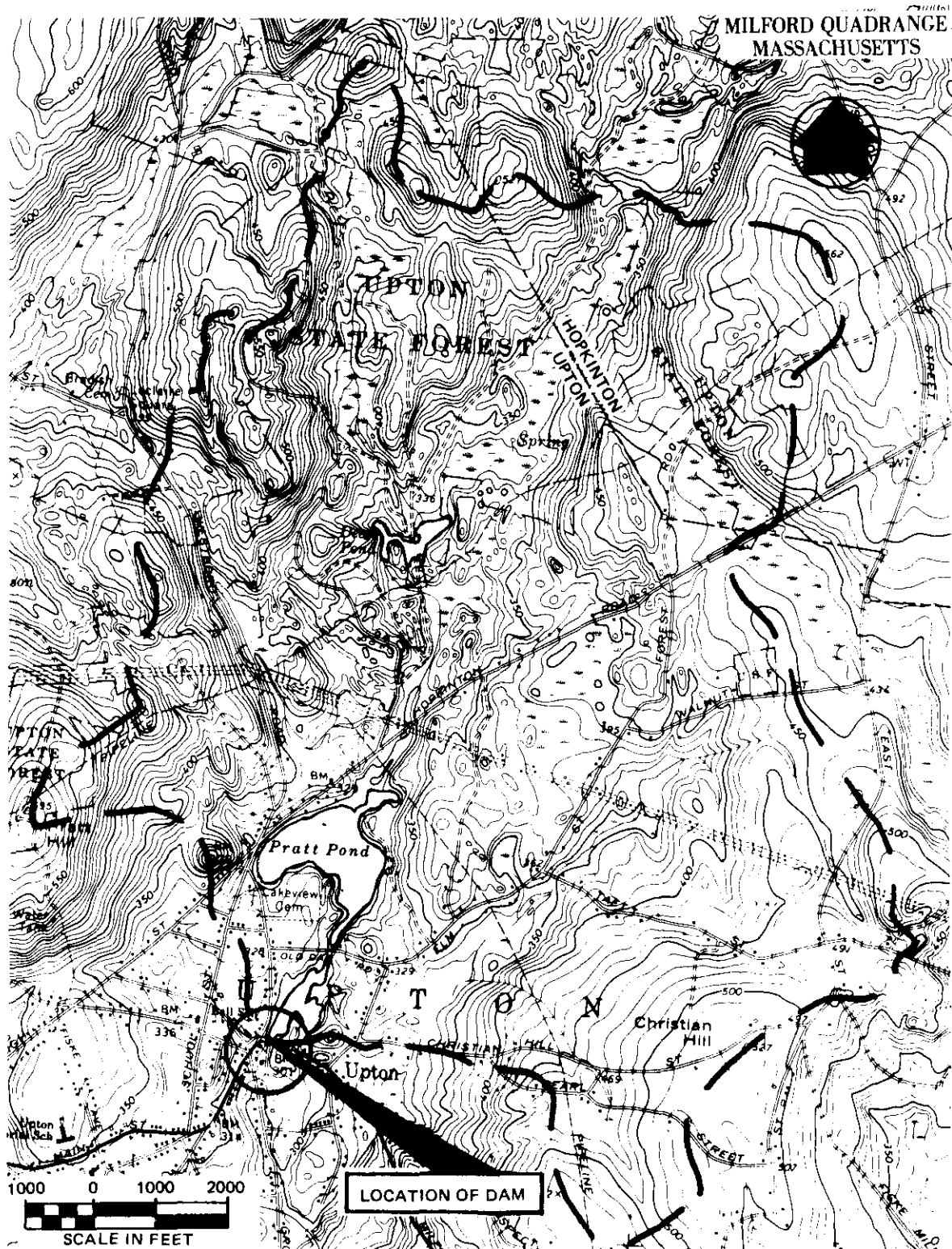
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**OVERVIEW
OLD GRIST MILL POND
UPTON, MASSACHUSETTS**



VIEW OF UPSTREAM FACE OF DAM

**Location and Direction of Photographs
Shown on Figure in Appendix B**



LOCATION MAP - OLD GRIST MILL POND DAM

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PHASE I INSPECTION REPORT

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SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Metcalf & Eddy, Inc. under a letter of July 28, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0306 has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
- (3) To update, verify and complete the National Inventory of Dams.

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1.2 Description of Project

- a. Location. The dam is located on Center Brook, a tributary of the Blackstone River, in the Town of Upton, Worcester County, Massachusetts (see Location Map).
- b. Description of Dam and Appurtenances. Old Grist Mill Pond Dam is an earthfill dam about 90 feet long with a maximum height of 24 feet (see Figures B-1 to B-5 in Appendix B). Route 140, which is located on the crest of the dam, is 56 feet wide including the road pavement, and a sidewalk, guard rail, and shoulder on each side of the road. The elevation (El) of the crest varies from 301.1 to 302.2. The upstream face of the dam consists of a vertical concrete headwall 60 feet long and 21 feet high. A grass-covered slope at about 3.5:1 is between the crest and the top of the headwall. The eastern 30 feet of the upstream face is grass-covered and at a 2.3:1 slope. The downstream face of the dam is a vertical concrete wall 43 feet long and 21.5 feet high. A grass-covered slope of 6:1 is between the crest and the top of the headwall. The downstream face adjacent to the headwall has been filled in to form a parking lot (east side) and grounds for a church (west side). Boring logs shown on Figure B-3 indicate that the dam is founded on glacial till.

An outlet structure containing three weirs and a gated outlet is located on the upstream face of the dam about 28 feet from the west abutment. This structure is 13 feet long by 21 feet high and consists of two vertical concrete sidewalls and two upstream bays separated by a concrete pier. The Construction Drawings (Figures B-3, B-4, and B-5) indicate a stone-paved 1.25:1 slope forming an approach channel on the east side of the outlet structure. The slope appeared to be filled in with soil at the time of the inspection. The east bay of the outlet structure is a 4.4 foot wide by 14.5 foot high

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opening mounted with about 15 8-inch flashboards. The top of the flashboards is at El 293.3. The west bay has a concrete headwall with a 4-foot high by 4.4-foot wide opening at the bottom controlled by a 4.5-foot high by 5-foot wide wooden slide gate. This serves as the outlet gate for the dam and has an invert at El 283.0. Soil has accumulated to El 284.7 upstream of the slide gate. The concrete sidewalls of the outlet structure are 1.3 feet thick and extend 7.5 feet (west wall) and 5.2 feet (east wall) upstream of the dam. Each sidewall contains a rectangular opening which functions as an overflow weir under high flow conditions. The openings are 3.8 feet high by 4.6 feet wide on the west wall and 3.7 feet high by 2.3 feet wide on the east wall. They have a combined weir length of 6.9 feet and are at El 293.9. Downstream of the flashboards and slide gate, the floor of the outlet structure slopes to a toe elevation of 280.5 (shown on Figure B-4).

A 10-foot wide by 16-foot high concrete box culvert is located directly downstream of the outlet structure. The culvert is 79 feet long, and the invert slopes from El 280.5 upstream to 280.0 downstream. Five 4-inch diameter drain holes were observed at about El 283 along the east wall of the conduit.

The culvert ends at the toe of the dam and leads to a downstream channel. The channel has vertical dry-stone masonry sidewalls and an earth and cobble bottom 15.5 feet wide (see Plan of Downstream and Sections, Figure B-2). The height of the sidewalls decreases downstream from 4.7 to 2.9 feet high on the east wall and from 8.9 to 3.5 feet on the west wall. The east wall is about 100 feet long, and the west wall is about 160 feet long. A steep earth slope rises about 15 feet above the east wall to a parking lot. The land adjacent to the west wall is about level with the top of the wall.

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- c. Size Classification. Old Grist Mill Pond Dam is classified in the "small" category since it has a maximum height of 24 feet and a maximum storage capacity of 115 acre-feet.
- d. Hazard Classification. Downstream of the dam is a lightly developed commercial and residential area for about 1,300 feet. There is a storage lot containing several tanks of heating oil located next to Center Brook about 500 feet downstream of the dam. At 650 feet downstream the brook passes through a 5-foot high by 13-foot wide culvert beneath Grove Street, which is a two-lane road to Upton Center. At 800 to 1,300 feet downstream, there are six residences which are on higher ground west of the stream bed. Below 1,300 feet, there is no development next to the stream. In the event of dam failure, it is unlikely that more than a few lives would be lost or more than an appreciable amount of damage would occur. Accordingly, the dam has been placed in the "significant" hazard category.
- e. Ownership. The dam is presently owned by the Town of Upton, Massachusetts. Mr. Henry Poirier, Road Commissioner of the Highway Department (617-529-3067), granted permission to enter the property and inspect the dam.
- f. Operator. The dam is operated by the Town of Upton Highway Department.
- g. Purpose of Dam. An old dam was originally built at the site to provide water for a grist mill. Previous inspection reports indicate that by 1950, the dam had deteriorated and only a small amount of water was impounded at that time. In 1953, the dam was rebuilt, and the pond is currently used for recreational activities such as boating and fishing.
- h. Design and Construction History. An original dam was built at the site some time prior to 1925. In March of 1953, heavy rains caused erosion and severe settlement of the roadway over the dam, and the outlet gates were in poor condition. In the latter part of 1953, the

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dam was reconstructed by the Massachusetts Department of Public Works. There are no drawings available on the original dam, however drawings dated 1953 show an outline of the old dam (see Figure B-4) and what the main construction changes were. The upstream headwall was moved about 27 feet upstream, widening the crest and the embankment. The new roadway was higher, raising the crest by about 1.5 feet. The floor of the box culvert was lowered about 6 feet, increasing the height from 10 feet to 16 feet. The outlet gates which used to be located at the downstream end of the box culvert were removed, and a new gate built upstream adjacent to the spillway. There is no information to indicate significant changes or repairs to the dam since 1953.

1. Normal Operating Procedures. The pond level is adjusted seasonally by adding two 8-inch flashboards to the weir of the spillway in late spring and removing them in late fall. The flashboards have eye-bolts and are accessible from an overhead concrete walkway. The outlet gate is reported to be operable and can be used to lower the pond in an emergency. Under normal conditions, the gate wheel is not left on the hoisting frame.

1.3 Pertinent Data

- a. Drainage Area. The approximate 2,650-acre (4.14 square mile) drainage area above the dam is generally sparsely developed and wooded. The northern one-third of the drainage area is a State park. The remainder is sparsely developed except in the vicinity of the pond which is moderately to thickly developed. Slopes range from 1 to 20 percent.

There are two dams upstream of Old Grist Mill Pond. Pratt Pond Dam is located 1,600 feet upstream and Dean Pond Dam is 7,800 feet upstream, both on Center Brook. A high-tension power line and a buried gas pipeline also craverse the drainage area.

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- b. Discharge at Dam Site. An outlet structure containing three weirs and a gated outlet is located on the upstream face of the dam about 28 feet from the west abutment. Normal discharge is over a weir made of flashboards which is 4.4 feet long and at El 293.3. Higher pond levels discharge over two side overflow weirs which have a combined length of 6.9 feet and are at El 293.9. Water can also be discharged through a 4-foot high by 4.4-foot wide slide gate opening which has an invert at El 283.0. Water discharging from all of these structures flows through a 79-foot long, box culvert through the embankment of the dam. The culvert is 10 feet wide by 16 feet high and has a slope of 1 percent.

Hydraulic analyses indicate that the combined flow over the flashboards and overflow weirs, and through the outlet gate would be 700 cfs when the water surface is at El 301 which is the approximate low point on the crest of the dam. An outflow test flood of 2,440 cfs will overtop the main dam by a maximum of 3.6 feet. The maximum flood which has occurred at the dam site is unknown. Personnel at the Upton Highway Department recall the dam was not overtopped in the 1955 hurricane, however, water overflowed from the west side of the pond onto North Main Street.

- c. Elevation (feet above Mean Sea Level (MSL)). A benchmark at El 298.0 was established at the top of the concrete walkway near the slide gate. This elevation is given on sheet 1 (Figure B-3) of the Construction Drawings.

- (1) Top dam: 301.1 to 302.2
- (2) Test flood pool: 304.7
- (3) Design surcharge (original design):
unknown
- (4) Full flood control pool: Not Applicable
(N/A)
- (5) Recreation pool: 293.3 top of flashboards

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- (6) Spillway crest (ungated):
293.3 top of flashboards
293.9 top of overflow weir
- (7) Upstream portal invert diversion tunnel:
N/A
- (8) Stream bed at centerline of dam:
284.7 natural pond bottom
283.0 invert of slide gate
- (9) Tailwater: 283.0

d. Reservoir

- (1) Length of maximum pool: 1,500 feet
- (2) Length of recreation pool: 1,500 feet
- (3) Length of flood control pool: N/A

e. Storage (acre feet)

- (1) Test flood surcharge: 100 at El 304.7
- (2) Top of dam: 115
- (3) Flood control pool: N/A
- (4) Recreation pool: 45 (Approximate)
- (5) Spillway crest: 45

f. Reservoir Surface (acres)

- *(1) Top dam: 9
- *(2) Maximum pool: 9
- (3) Flood-control pool: N/A

*Based on the assumption that the surface area will not significantly increase with changes in reservoir elevation from 293.3 to 301.1.

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(4) Recreation pool: 9

(5) Spillway crest: 9

g. Dam

(1) Type: earthfill

(2) Length: 90 feet

(3) Height: maximum 24 feet

(4) Top width: 56 feet

(5) Side slopes: vertical upstream and
downstream

(6) Zoning: Unknown

(7) Impervious core: None

(8) Cutoff: Unknown, founded on glacial till

(9) Grout curtain: None

i. Spillway

(1) Type: flashboards

(2) Length of weir: 4.4 feet at flashboards
6.9 feet at overflow weirs

(3) Crest elevation: 293.3 top of flashboards

(4) Gates: None

(5) Upstream Channel: Stone-paved side slope
east of spillway

(6) Downstream Channel: 10-foot wide by 16-foot
high by 79-foot long concrete box culvert
leading to stream bed

j. Regulating Outlets. The regulating outlet at
the dam is a 4.5-foot high by 5-foot wide wooden
slide gate which controls a 4-foot high by
4.4-foot wide outlet opening. This outlet is

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located on the upstream face of the dam about 25 feet from the west abutment. The gate is operated by a Rodney-Hunt gate wheel and hoist frame mounted on an overhead concrete walkway.

The pond level can also be regulated by removing or adding flashboards from the spillway. The drawings dated 1952 show that these flashboards continue down to the same invert elevation as the slide gate. The flashboards have eye-bolts and can be removed by hoisting from the overhead walkway.

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SECTION 2

ENGINEERING DATA

- 2.1 General. The only plans, specifications or computations available from the Owner, State, or County offices relative to the design and construction of this dam are three sheets of drawings by the Massachusetts Department of Public Works dated November, 1952, showing the proposed reconstruction of the old dam (copies in Appendix B). The only other data available for this evaluation were visual observations made during inspection, review of previous inspection reports, and conversations with personnel at the Town of Upton Highway Department, and State and County agencies.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Department of Public Works: Messrs. Willis Regan and Raymond Rochford, and of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways: Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office: Messrs. John O'Toole and Joseph Brazauskas.

In addition, we thank Mr. Henry Poirier, Road Commissioner, Town of Upton Highway Department, who allowed us to inspect the dam and provided information on its operation.

- 2.2 Construction Records. There are no detailed construction records available.
- 2.3 Operating Records. No operation records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.
- 2.4 Evaluation.
- a. Availability. There is limited engineering data available.

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- b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.
- c. Validity. The limited engineering data available is valid.

SECTION 3
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at Old Grist Mill Pond was performed on August 23, 1978. A copy of the inspection check list is included in Appendix A. Previous inspections by others have been made since 1925. A partial listing of these inspections is in Appendix B. An inspection was made by the Massachusetts Department of Public Works in 1976. A copy of their report is included in Appendix B.
- b. Dam. Old Grist Mill Pond Dam is an earthfill embankment with a state highway on the crest and concrete headwalls on the upstream and downstream slopes. The embankment is generally in good condition, but several minor signs of distress were observed. Slight seepage was noted at the bottom of the downstream headwall about 10 feet west of the discharge conduit. A small tree is growing next to the downstream headwall about 15 feet east of the discharge conduit. Surface runoff has caused erosion of the upstream and downstream slopes at the west abutment of the dam. Minor cracking of the asphalt pavement on the highway and on the sidewalks was also observed.
- c. Appurtenant Structures. A concrete spillway and outlet structure is located on the upstream face of the dam. This structure consists of two upstream bays, the east bay containing flashboards functions as the main spillway and the west bay containing a concrete headwall and wooden slide-gate functions as an outlet. Two rectangular openings in the sidewalls serve as high water overflow weirs. Water discharging from all of these structures is conducted through the embankment inside a concrete box culvert and into a stream bed below the dam.

Severe erosion and spalling of the concrete has occurred along the water line of the outlet structure. The upstream edges of the sidewalls and of the pier separating the bays all

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show signs of spalling at the water line and are in poor condition. Rusting was also noted along the keyway for the flashboards, and it was observed that the joints between the outlet structure and the upstream headwall are open and unfilled. The downstream face of the center pier and the headwall above the slide gate is eroded and pieces of concrete are missing. Slight seepage was observed flowing from the top of the slide gate.

The concrete of the box culvert is generally in good condition. There is some slight erosion and staining along the water line. Some slight seepage is also occurring along two construction joints, and diagonal efflorescence was observed about midway in the culvert. The concrete walls contain small patches where construction ties have been cut off. Rock debris has accumulated on the floor of the culvert.

The stream bed below the box culvert is thickly overgrown and in poor condition. The stonework in the sidewalls is deteriorating, and blocks of rock are overhanging and falling into the channel. Other rocks and riprap washed downstream have accumulated in the floor to a level about 2 feet above the invert of the box culvert. Numerous trees and brush are growing along the sides and bottom of the stream bed, especially on the east side slope where 24-inch and 30-inch diameter trees are growing.

- d. Reservoir Area. The area around Old Grist Mill Pond is lightly developed and contains a cemetery and about 40 residences. It is possible that some future development could occur along the eastern shore of the pond. The area is generally wooded or grassed with moderate slopes of 5 to 15 percent.
- e. Downstream Channel. Discharge from the dam flows downstream in Center Brook which slopes at 1.4 percent. There are three downstream culverts: a 5-foot high by 13-foot wide box culvert beneath Grove Street 650 feet downstream, a 7.5-foot high by 20-foot wide box culvert beneath

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Station Street 2,800 feet downstream, and two 9-foot high by 9-foot wide box culverts beneath Mendon Street 6,000 feet downstream.

- f. Evaluation. Although the dam appears to be in good condition, repairs are needed to the outlet structure and the downstream channel needs to be cleared. It is evident that these structures are not adequately maintained. Recommended measures to improve these conditions are stated in Section 7.3.

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SECTION 4

OPERATING PROCEDURES

- 4.1 Procedures. The dam is operated seasonally by members of the Town of Upton Highway Department, who reportedly add two 8-inch flashboards to the weir in late spring and remove them in late fall. The flashboards contain eye-bolts for ease of removal and are accessible from the overhead concrete walkway. The control wheel for the outlet gate is kept by the Highway Department. The gate is reportedly operable and can be used in an emergency to draw down the pond.
- 4.2 Maintenance of Dam. There is no regular program of maintenance for the dam and it is evident that the dam is not adequately maintained. Seepage and tree growth is beginning to occur at the downstream toe and surface runoff is eroding the upstream and downstream slopes at the west abutment.
- 4.3 Maintenance of Operating Facilities. The concrete on the outlet structure is severely eroded and in poor condition. The stream bed below the dam is thickly overgrown, the sidewalls are deteriorating, and rock has accumulated in the bottom. The concrete walls of the box culvert require minor repair and rock debris has accumulated on the floor of the culvert.
- 4.4 Description of Any Warning Systems in Effect. There are no warning systems in effect at this dam.
- 4.5 Evaluation. There are no maintenance or warning systems in effect at Old Grist Mill Pond Dam. This is undesirable, considering the dam is in the "significant" hazard category. A program of regular maintenance for this dam should be implemented, as recommended in Section 7.3 Remedial Measures.

OLD GRIST MILL POND DAM

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. Design Data. The probable maximum flood (PMF) rate was determined to be 1,600 cfs per square mile. This calculation is based on an average drainage area slope of 3 percent, the pond-plus-swamp area to drainage area ratio of 7 percent, and the U.S. Army Corps of Engineers' Flow Rates (dated December 1977). Applying one-half the PMF to the 4.14 square miles of drainage area results in a calculated peak flow of 3,310 cfs as the inflow test flood. The inflow test flood was adjusted for surcharge storage in both Old Grist Mill Pond and Pratt Pond, located upstream, which is at nearly the same elevation. The maximum discharge rate was established as 2,440 cfs with a water surface at El 304.7.

Flow over the crest of the dam due to the test flood is predicted to be 1,640 cfs while the combined flow over the flashboards, overflow weirs, and through the outlet gate would be 800 cfs. The maximum head on the dam would be 3.6 feet with a discharge of 16.4 cfs per foot of width. The depth of water over the dam at critical flow would be at 2 feet with a velocity of 8.2 fps.

Hydraulic analyses indicate that the combined flow over the flashboards and overflow weirs, and through the outlet gate would be 700 cfs when the water surface is at El 301 which is the approximate low point on the crest of the dam.

- b. Experience Data. Hydraulic records are not available for this dam. Personnel at the Upton Highway Department recall that in 1955 the dam was not overtopped, however, water did overflow from the west side of the pond onto North Main Street.

OLD GRIST MILL POND DAM

- c. Visual Inspection. The Old Grist Mill Pond Dam is essentially a highway embankment carrying State Highway No. 140. Discharge is through the outlet structure and into a 10-foot wide by 16-foot high concrete box culvert. The outlet structure is rectangular in plan. The two sidewalls each contain a rectangular opening with an overflow weir at El 293.9. The two weirs have a total length of 6.9 feet.

The upstream face of the outlet structure contains a low level gate 4 feet high by 4.4 feet wide with an invert at El 283.0. A vertical slot, 4.4 feet wide with an invert at El 283 is also built into the upstream face of the structure. This slot is filled with flashboards up to El 293.3, forming a 4.4-foot by 4.4-foot opening.

The structure was built in 1953. The condition of the structure is generally good, although severe spalling and erosion of concrete was noted on the upstream edges of the piers at the water line.

A 2-foot deep deposit of rock and sediment occurs in the lower end of the culvert. This deposit produces a channel invert which is consistent with downstream levels. During high discharges, the downstream channel is likely to deepen which would facilitate the removal of sediment in the culvert, allowing that structure to operate at full capacity.

- d. Overtopping Potential. Overtopping of the dam is expected under the test flood. Discussion with personnel at the Upton Highway Department indicated that the dam was not overtopped during the 1955 hurricane, however, water did overflow from the west side of the pond onto North Main Street. In the event of overtopping, complete failure of the dam is unlikely to occur. The highway pavement and concrete headwalls will serve to protect the dam under flood conditions. However, erosion of the dam could occur, resulting in a breach or

OLD GRIST MILL POND DAM

partial failure of the dam. In the unlikely event the dam fails during the peak discharge of the test flood, the water elevation in the discharge channel would rise only about 1.8 feet over its prior level.

OLD GRIST MILL POND DAM

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. The evaluation of the structural stability of Old Grist Mill Pond Dam is based on the visual inspection conducted on August 23, 1978. As discussed in Section 3, Visual Inspection, the dam is generally in good condition, although the concrete on the outlet structure is severely eroded and spalled.

Based on these observations, the embankment of the dam does not appear to be unstable and is not considered a potential hazard.

- b. Design and Construction Data. There are three sheets of drawings dated 1952 available from the County and the State on the design and construction of the dam (see Figures B-3, B-4, and B-5 in Appendix B). There are no other plans, specifications or computations available on the design, construction or repair of this dam from the Owner, County or State offices. Furthermore, information does not appear to exist on the type, shear strength and permeability of the soil and/or rock materials of the embankment.

Old Grist Mill Pond Dam was originally built some time prior to 1925 and was reconstructed in 1953. Reconstruction consisted mainly of widening the embankment in the upstream direction, construction of a new outlet structure on the upstream face of the dam, and enlargement of the box culvert through the embankment. The drawings do not indicate the zoning of the original dam or the added embankment. The upstream stone headwall of the original dam appears to have been left in place inside the new embankment (see Figure B-4). Drainage holes are shown to exist in the upstream concrete headwall and were observed in the east wall of the box culvert. The drawings do not show the presence of any cutoff beneath the dam. Test borings shown on Figure B-3 indicate that the dam is founded on glacial till.

OLD GRIST MILL POND DAM

- c. Operating Records. There is no evidence of instrumentation of any type in Old Grist Mill Pond Dam, and there is nothing to indicate that any instrumentation was ever installed in this dam. The performance of this dam under prior loading can only be inferred by physical evidence at the site.
- d. Post-Construction Changes. There are no as-built drawings available for Old Grist Mill Dam. The drawings dated 1952 show an outline of the original dam and proposed changes constructed in 1953. No other significant changes are known to have been made since 1953.
- e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analyses.

OLD GRIST MILL POND DAM

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. Based upon the visual inspection of the site, the limited engineering data, and a lack of operational or maintenance information, there are deficiencies which must be corrected to assure the continued performance of this dam. Generally, the dam is considered to be in good condition although the concrete on the outlet structure is eroded and in poor condition. Several signs of distress were observed at the site: erosion and spalling of the concrete on the outlet structure; slight seepage at the top of the outlet gate; heavy growth of trees and brush on the sides and floor of the downstream channel; accumulation of rock and soil in the floor of the box culvert and in the downstream channel to a level about 2 feet above the invert of the box culvert; deterioration of the stonework on the sides of the downstream channel; slight seepage at the toe of the dam 10 feet west of the box culvert; a small tree growing at the toe of the dam east of the box culvert; erosion of the embankment slopes near the west abutment due to surface runoff; and minor efflorescence and seepage in the walls of the box culvert.

Hydraulic analyses indicate that combined flow over the flashboards, overflow weirs and through the outlet gate would be 700 cfs when the water surface is at El 301.1 which is the low point on the crest of the dam. An outflow test flood at 2,440 cfs will overtop the dam by a maximum of 3.5 feet. The outlet structure can only discharge 29 percent of the test flood before overtopping the dam.

OLD GRIST MILL POND DAM

- b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.
- c. Urgency. The remedial measures outlined below should be implemented by the Owner within two years after receipt of this Phase I Inspection Report. However, repair of the concrete in the outlet structure should be done by the Owner within one year.
- d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the dam are not required at the present time. Recommendations on repairs and maintenance procedures are stated below in Section 7.3 Remedial Measures.

7.2 Recommendations. As a result of the visual inspection and a review of available data, further investigations to assess the adequacy of the dam are not considered necessary at this time. Future changes within the watershed, the downstream area or to the dam may necessitate further investigations.

The Recommendations on repairs and maintenance procedures are outlined below under Section 7.3, Remedial Measures.

7.3 Remedial Measures

- a. Operating and Maintenance Procedures. The dam and appurtenant structures are not adequately maintained. It is recommended that the Owner accomplish the following:
 - (1) repair the concrete on the upstream and downstream faces of the outlet structure
 - (2) fill in joints where the structure meets the upstream wall of the dam; repair leakage at the top of the outlet gate

- (3) clear trees and brush from the sides and floor of the downstream channel
- (4) remove the 2-foot thickness of accumulated rock and soil from the floor of the box culvert and from the downstream channel
- (5) repair deteriorating stonework in the walls of the downstream channel
- (6) monitor the seepage at the toe of the dam west of the box culvert
- (7) clear the tree at the toe of the dam east of the box culvert
- (8) repair erosion of the upstream and downstream slopes of the dam near the west abutment
- (9) repair minor efflorescence and seepage at construction joints in the walls of the box culvert
- (10) implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations
- (11) institute a definite plan for surveillance and a warning system during periods of unusually high rains and/or runoff
- (12) periodic technical inspections of this dam should be continued on an annual basis.

7.4 Alternatives. An alternative to implementing the recommendations and remedial measures itemized above would be to drain the pond and breach or remove the dam.

APPENDIX A
PERIODIC INSPECTION CHECKLIST

OLD GRIST MILL POND DAM

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT Old Grist Mill Pond Dam

DATE 8-23-78

TIME 8:00AM to 12:00AM

WEATHER sunny - 70°F

W.S. ELEV. 243.4* U.S. 283.6* DN.S.

*based on assumed benchmark elevation of 248.0 MSL at top of walkway near outlet gate

PARTY:

- | | |
|-------------------------|---|
| 1. <u>Ed Greco</u> | 6. _____ |
| 2. <u>Lyle Branagan</u> | 7. <u>Frank Sviokla</u> |
| 3. <u>Sue Pierce</u> | 8. <u>Henry Lord</u> |
| 4. <u>Carol Sweet</u> | 9. <u>Mike Pacello - Mass. Div. Waterways</u> |
| 5. <u>Dave Cole</u> | 10. <u>Henry Poirier - Upton Hwy Dept.</u> |

PROJECT FEATURE

INSPECTED BY

REMARKS

- | | | |
|--------------------|---------------------------------|--|
| 1. <u>Dam</u> | <u>Ed Greco / Carol Sweet</u> | |
| 2. <u>Spillway</u> | <u>Lyle Branagan / Ed Greco</u> | |
| 3. _____ | _____ | |
| 4. _____ | _____ | |
| 5. _____ | _____ | |
| 6. _____ | _____ | |
| 7. _____ | _____ | |
| 8. _____ | _____ | |
| 9. _____ | _____ | |
| 10. _____ | _____ | |

PERIODIC INSPECTION CHECK LIST

PROJECT Old Grist Mill DATE 8/23/78
 PROJECT FEATURE dam NAME Ed Greco
 DISCIPLINE geotechnical NAME Carol Sweet

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT -1953- marked on DS headwall	
Crest Elevation	varies from 301.1 to 302.2
Current Pool Elevation	293.4
Maximum Impoundment to Date	unknown
Surface Cracks	minor cracking in asphalt pavement on road and sidewalks
Pavement Condition	good
Movement or Settlement of Crest	road profile appears uniform
Lateral Movement	walls straight - no movement visible
Vertical Alignment	Rte 140- State Highway - flat grade
Horizontal Alignment	transverse slope - pavement curved, arched upstream
Condition at Abutment and at Concrete Structures	west - ties into stone wall east - ties into natural ground } good condition
Indications of Movement of Structural Items on Slopes	US + DS headwalls - vertical curb - straight aluminum guard rail - straight } none visible
Trespassing on Slopes	small paths US of abutments along pond + DS along west wall - small trees US along East shore.
Sloughing or Erosion of Slopes or Abutments	slight erosion US + DS slopes - west side - due to runoff from curb line + sidewalk
Rock Slope Protection - Riprap Failures	no rip rap visible
Unusual Movement or Cracking at or near Toes	none visible
Unusual Embankment or Downstream Seepage	slight seep at DS toe 10' west of box culvert
Piping or Boils - none visible Concrete Headwall -	good condition - small weeds in joint - fill material falling out - tree at DS toe, east corner
Foundation Drainage Features	5- 4" weep holes in east wall of box culvert
Toe Drains	unknown
Instrumentation System	none

PERIODIC INSPECTION CHECK LIST

PROJECT Old Grist Mill DATE 8/23/78
 PROJECT FEATURE spillway NAME Lyle Branagan
 DISCIPLINE geotechnical NAME Ed Greco

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	<u>None</u>
General Condition	<u>NA (not applicable)</u>
Loose Rock Overhanging Channel	<u>NA</u>
Trees Overhanging Channel	<u>NA</u>
Floor of Approach Channel	<u>NA</u>
b. Weir and Training Walls	<u>8" wooden flashboards - 2 eye bolts at top boards covered with plastic sheet - *boards unknown</u>
General Condition of Concrete	<u>poor - severe erosion of weir piers</u>
Rust or Staining	<u>slight - Keyway for flashboards</u>
Spalling	<u>nose piers for weir</u>
Any Visible Reinforcing	<u>none</u>
Any Seepage or Efflorescence	<u>none visible</u>
Drain Holes	<u>none</u>
c. Discharge Channel	<u>rectangular channel DS of box culvert + earth bottom w/ stone masonry walls</u>
General Condition	<u>fair to poor</u>
Loose Rock Overhanging Channel	<u>dislodged + fallen stones from masonry sidewalls</u>
Trees Overhanging Channel	<u>24" + 30" dia trees on east side, dense brush on both sides</u>
Floor of Channel	<u>earth + cobbles - floor built up 2 ft. above culvert invert - brush - some debris</u>
Other Obstructions	<u>12" dia culvert from parking lot located 73' DS on west wall</u>

PERIODIC INSPECTION CHECK LIST

PROJECT Old Grist Mill Pond

DATE 8/23/78

PROJECT FEATURE outlet works

NAME Ed Greco

DISCIPLINE geotechnical

NAME Carol Sweet

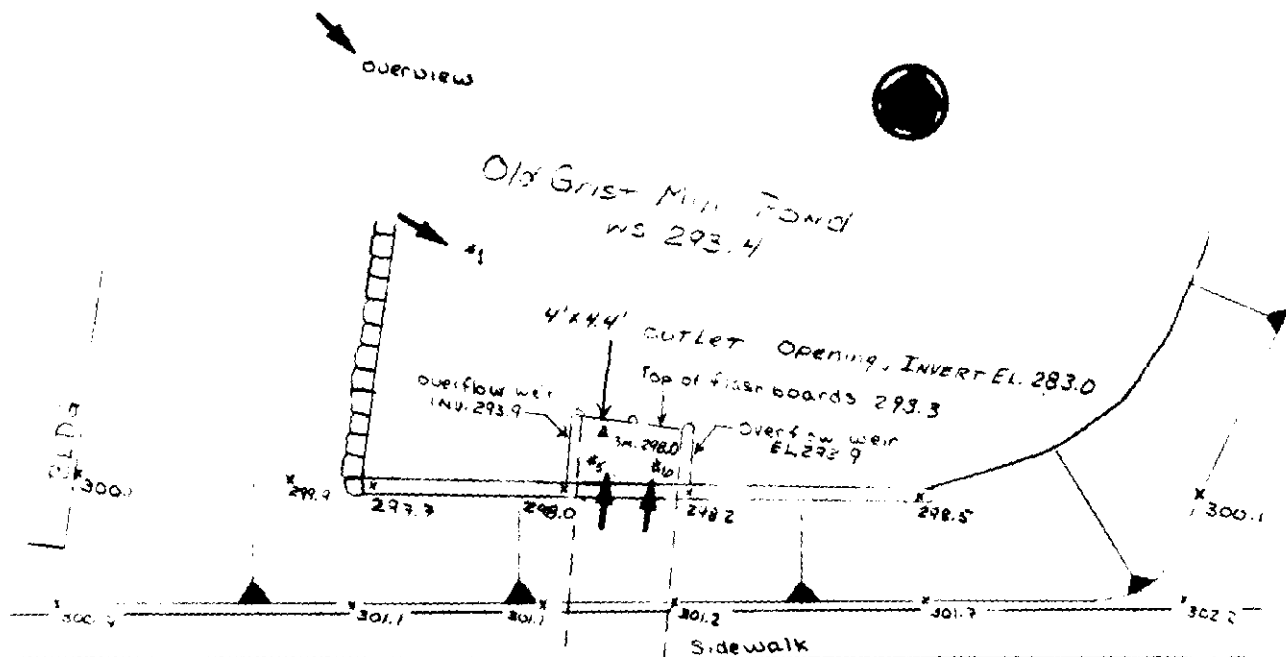
AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	wooden slide gate - hand wheel & mechanism on overhead concrete walkway
General Condition of Concrete	fair except for severe erosion on nose piers, corrosion & cavitation on DS side of headwall
Rust or Staining	slight staining of screw stem
Spalling	severe on nose piers
Erosion or Cavitation	severe on nose piers
Visible Reinforcing	none visible
Any Seepage or Efflorescence	seepage at top of wooden slide gate
Condition at Joints	open joints at headwall
Drain Holes	5-4" weep holes on east wall of box culvert
Channel	concrete box culvert under dam
Loose Rock or Trees Overhanging Channel	NA (not applicable)
Condition of Discharge Channel	good - small patches in walls, slight seepage along 2 joints + diagonal efflorescence near middle of culvert - slight erosion along water line - 4" drain holes (5) along water line east wall - rip rap on floor of culvert - ogee shaped bottom of channel DS of slide gate

* outlet gate mechanism: Rodney-Hunt Machine Co., Orange, Mass.
Type - 55012A
Shop No. 690

APPENDIX B
PLANS OF DAM AND PREVIOUS
INSPECTION REPORTS

	<u>Page</u>
Figure B-1 Plan of Dam	B-1
Figure B-2 Plan of Downstream Channel and Sections	B-2
Figures B-3, B-4, and B-5 Drawings of Dam, dated November 1952	Fold Outs
Previous Inspections (partial listing)	B-6
Inspection by Massachusetts Department of Public Works, dated January 12, 1972	B-7

OLD GRIST MILL POND DAM

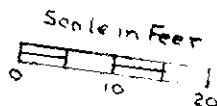
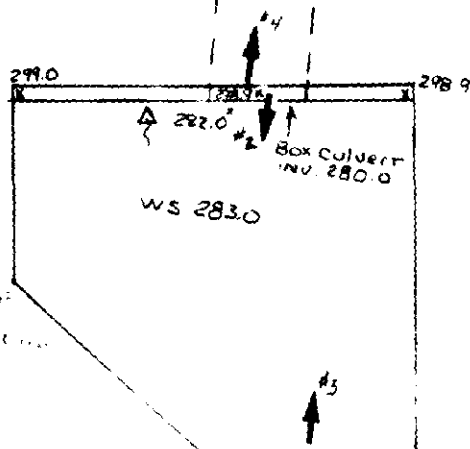


Rt. 140

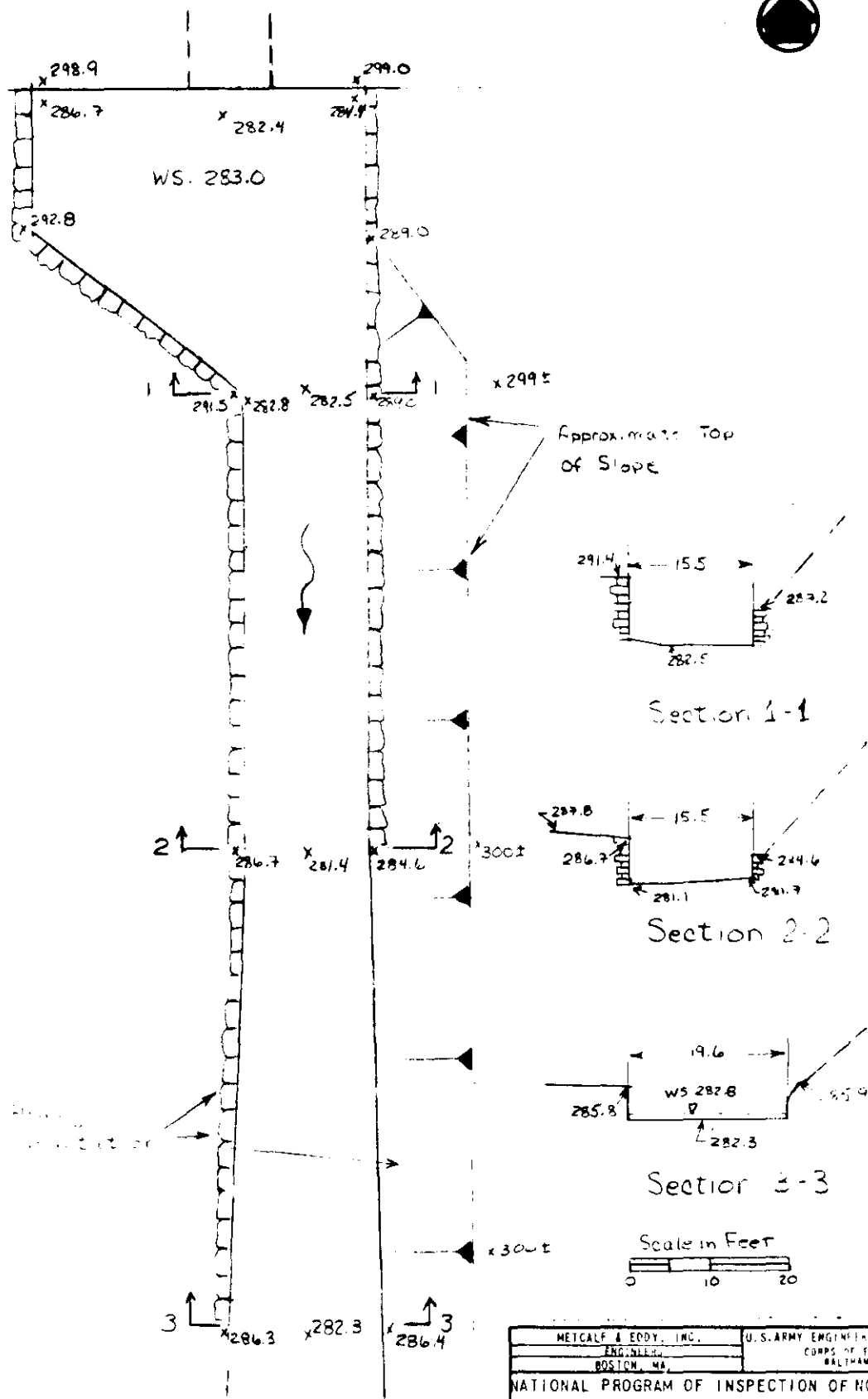
Sidewalk

NOTES:

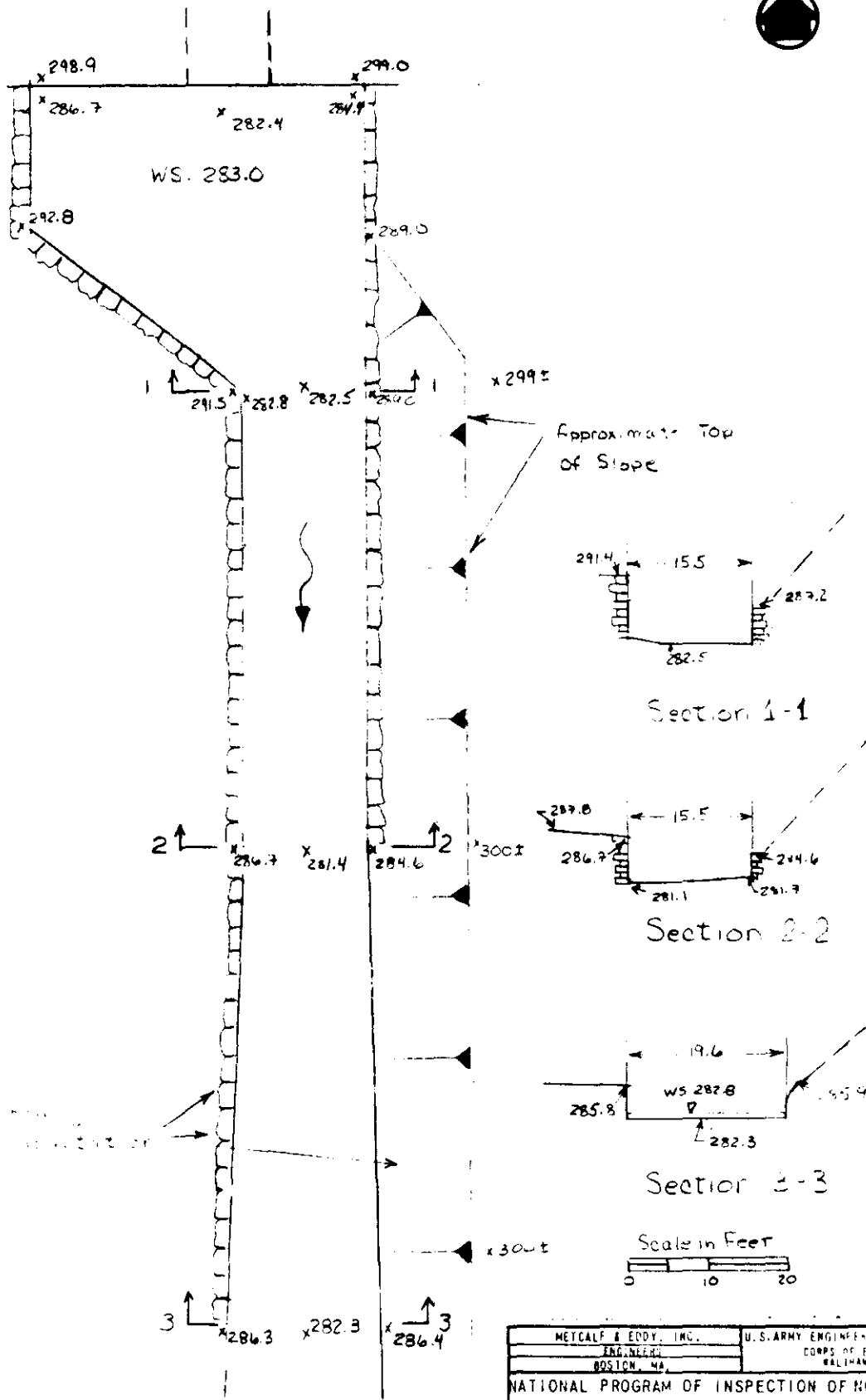
1. ELEVATIONS SHOWN ARE BASED ON ASSUMED ELEVATION OF WALKWAY OUTLET, 298.0 (M.S.)
2. Information shown from field survey of July 25, 1974
3. → #2 denotes structure shown in photograph.



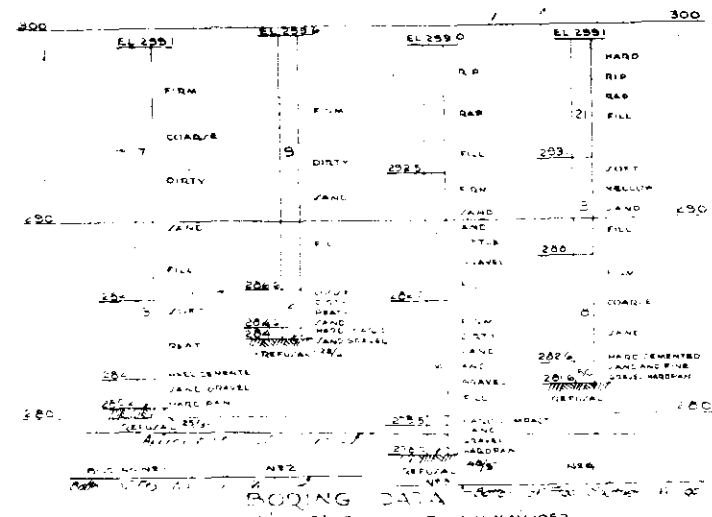
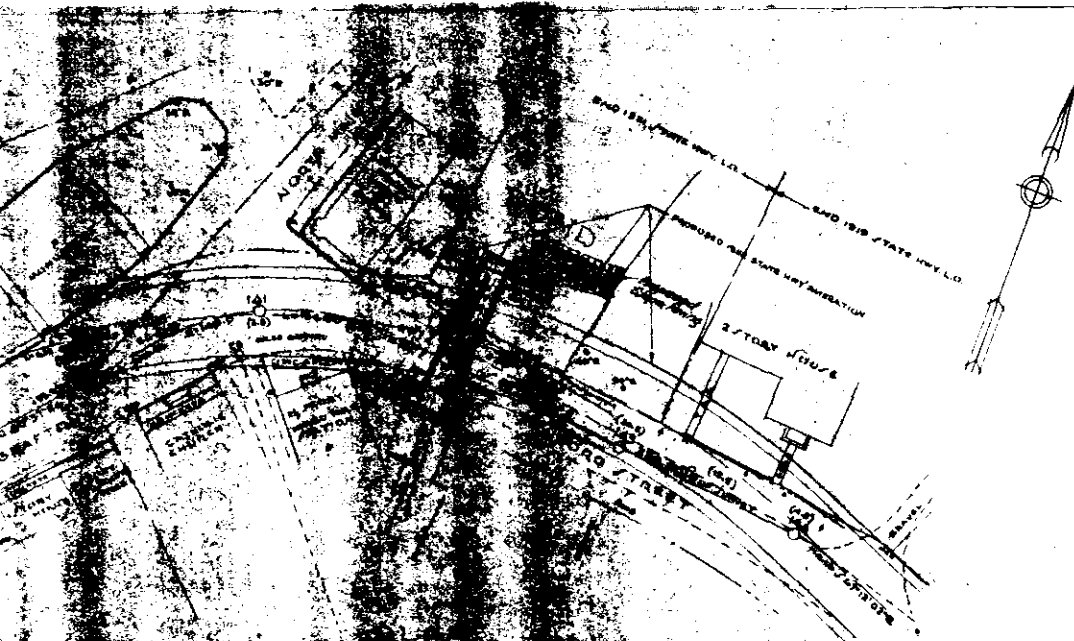
DESIGNED BY: J. J. J.	U.S. ARMY ENGINEER DIV. NEW ENGL. DIST. CORPS OF ENGINEERS
REVISION: 1	BY: J. J. J.
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	
OLD GRIST MILL POND DAM	
FIGURE B-1 PLAN OF DAM	
TRIBUTARY BLACKSTONE RIVER	
SCALE: 1" = 20'	MASSACHUSETTS
DATE: OCTOBER, 1974	



METCALF & EDDY, INC.	U.S. ARMY ENGINEER DISTRICT OFFICE
ENGINEERS	CORPS OF ENGINEERS
BOSTON, MA	BALTIMORE, MD
NATIONAL PROGRAM OF INSPECTION OF NON FED DAMS	
OLD GRIST MILL POND DAM	
FIGURE D-2	
PLAN OF DOWNSTREAM CHANNEL AND SECTIONS	
TRIBUTARY BLACKSTONE RIVER MASSACHUSETTS	
SCALE: 1" = 20'	DATE: OCTOBER, 1978



METCALF & EDDY, INC.	U.S. ARMY ENGINEER CORPS
ENGINEERS	CORPS OF ENGINEERS
BOSTON, MA	WALHAM, MA
NATIONAL PROGRAM OF INSPECTION OF NON FED DAMS	
OLD GRIST MILL POND DAM	
FIGURE B-2	
PLAN OF DOWNSTREAM CHANNEL AND SECTIONS	
TRIBUTARY BLACKSTONE RIVER	MASSACHUSETTS
SCALE: 1" = 20'	DATE: OCTOBER, 1978



GENERAL NOTES

FOUNDATION
MAY BE ALTERED IF NECESSARY TO SUIT CONDITIONS OF GROUND/STRUCTURE

DATE
DATE TO BE PLACED IN CENTER OF OUTSIDE FACE OF DOWNSTREAM CURBING AS SHEET SHOWING SIZE AND CHARACTER OF NUMERALS WILL BE FURNISHED

DESIGN
ACCORDING TO SPECIFICATIONS OF AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS (1945 ED.) FOR H20-44 LOADING

BENCH MARK
STATION 140+34.17, 54.17 M.G. D.V.C. 11-11 EL. 288.97
SEA LEVEL DATUM OF 1929

REINFORCEMENT
ALL REINFORCING STEEL BARS SHALL CONFORM TO A.S.T.M. DESIGNATION A 305-49

HYDRAULIC DATA
DRAINAGE AREA AT 1.0 MILE /
DESIGNED FOR MAJOR FLOOD
ESTIMATED DISCHARGE 830 CU FT PER SEC
VELOCITY OF FLOOD FLOW 14.0 FT PER SEC

* ASSUMED BENCHMARK FOR METAL FLOOD SURVEY, E. 288.0 (M.S.L.) LOCATED AT TOP OF OUTLET STRUCTURE NEAR SLICESATE

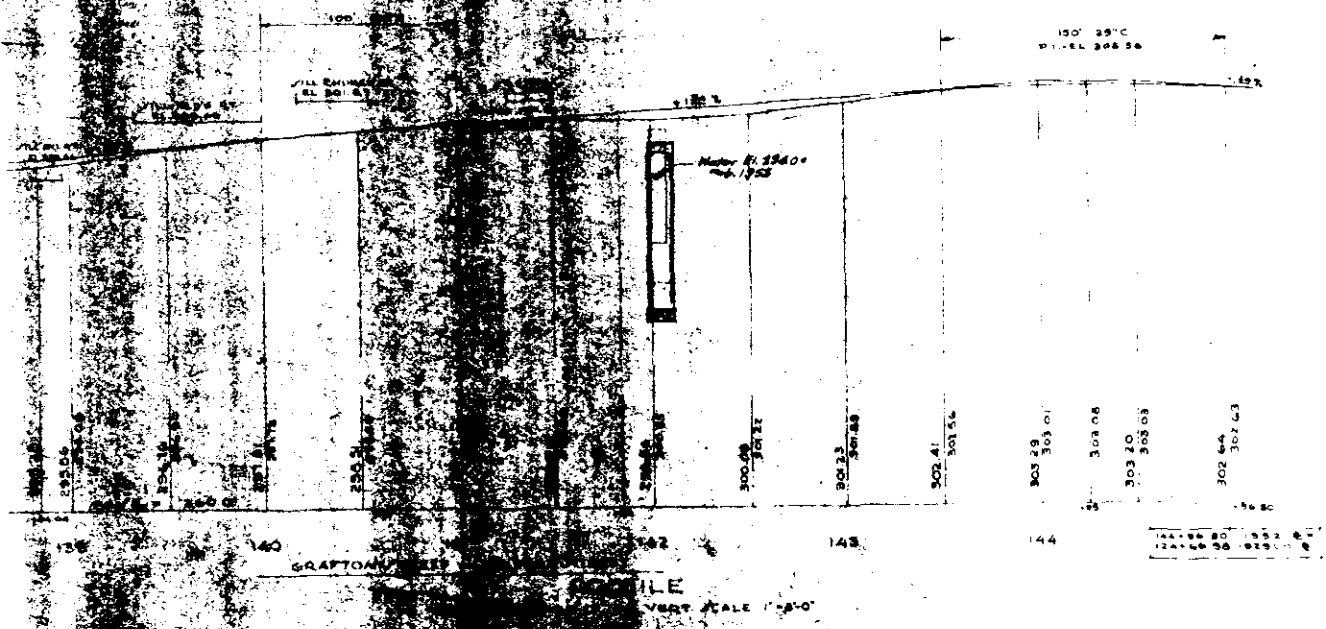
BORING DATA
SCALE 1" = 10' BORINGS TAKEN MAY 1952

BORING NOTES
LOCATION OF BORINGS SHOWN IN PLAN. PLAN THUS ALL BORINGS TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS OF GROUND. BORINGS TAKEN AT 10' INTERVALS. SHOW NATURE OF MATERIAL TO BE ENCOUNTERED IN CONNECTION WITH THE CONSTRUCTION OF BRIDGE.

1. BORING NO. 1 LOCATED BELOW THE FOOT OF DAM. OBSERVED BY 30" FALL OF 40" HAMMER. JAMMING FROM BORING MAY BE SEEN AT THE INTERIOR OF THE DAM. BORING NO. 100 MAY BE A STREET BOTTLE NEAR

ESTIMATED QUANTITIES
(NOT GUARANTEED)

UNCLASSIFIED EXCAVATION	111,950	CU YDS.
CLASS B ROCK EXCAVATION	50	CU YDS.
GRAVEL BORING	600	CU YDS.
CLASS A CEMENT CONCRETE MAJORITY	229	CU YDS.
CLASS B CEMENT CONCRETE MAJORITY	370	CU YDS.
STEEL REINFORCING FOR STRUCTURE	23,000	POUNDS
DITUMENING SAND PROOFING	580	CU YDS.
FLOPPY DRAINAGE SAND PROOFING	90	CU YDS.
STONE WALL / CONCRETE / SAND PROOFING	30	CU YDS.
DOWN PIPE HAND RAIL	25	138 FT
GATE AND GATE HOIST		LUMP SUM
STOP PLANKS AND GUIDES		LUMP SUM



WORCESTER COUNTY COMMISSIONERS
WORCESTER COUNTY ENGINEERING DEPARTMENT

PLANS OF
CONSTRUCTION OF DAM
STATE HIGHWAY EMBANKMENT
AT SNOWS MILL POND - UPTON, MASS.
OWNED BY THE TOWN OF UPTON
AS FILED AND APPROVED BY THE
COUNTY COMMISSIONERS
SCALES AS NOTED

APPROVED: _____ SUBMITTED: Feb. 7, 1955

CHAIRMAN OF COUNTY COMMISSIONERS: _____ COUNTY ENGINEER: *D. O. Marshall*

COUNTY COMMISSIONER: _____ ENGINEERS: *M. D. P. W.*

COUNTY COMMISSIONER: _____ DAM NO. 52-05

FILED FOR CONSTRUCTION

THE COMMONWEALTH OF MASSACHUSETTS
BRIDGE

UPTON

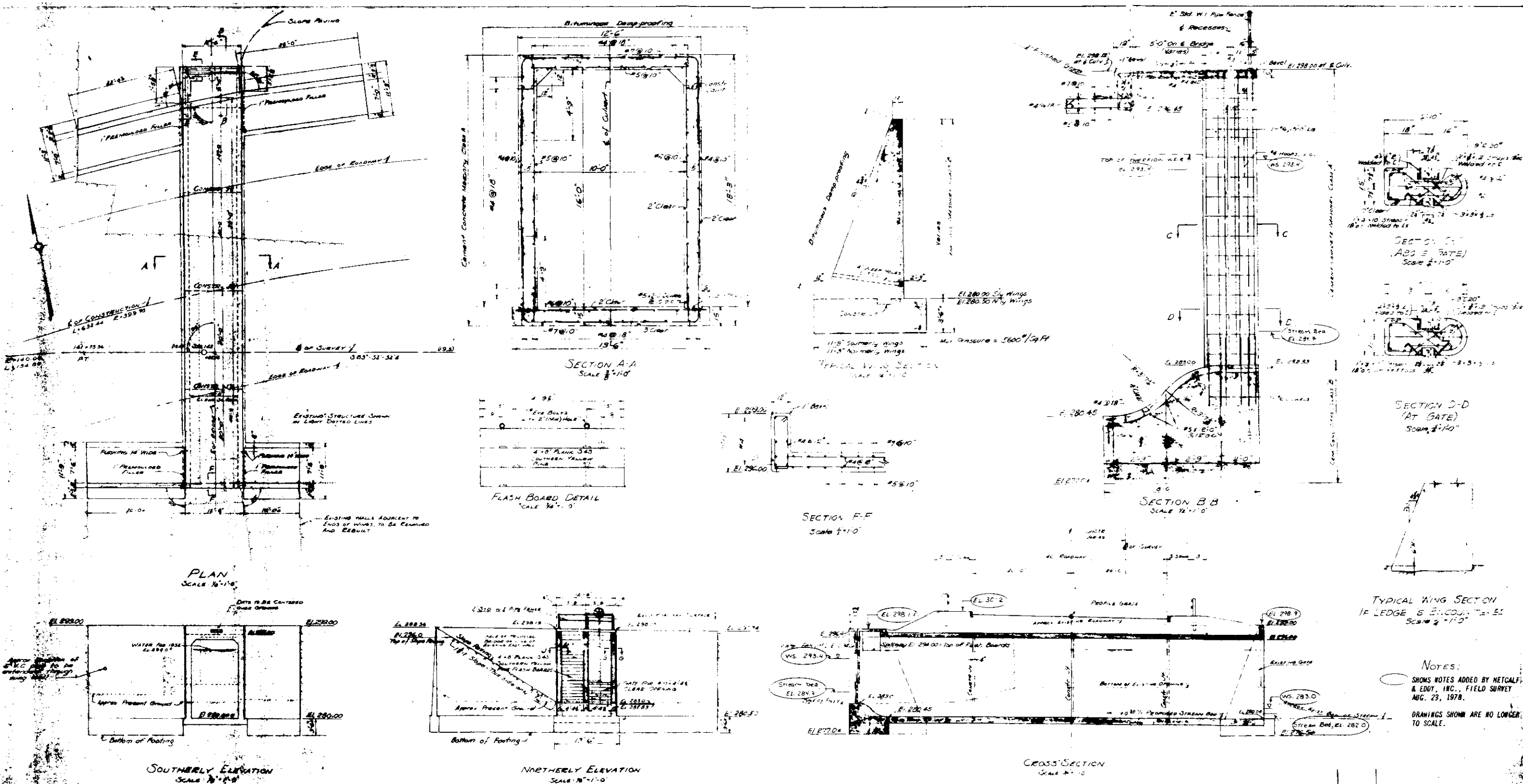
111 LEGG STREET, STATION 142+2.16
OVER MILL BROOK
SCALE AS NOTED

OFFICE OF
DEPARTMENT OF PUBLIC WORKS
100 N. HUA ST. - BOSTON, MASS.
NOV. 1952

J. P. Marshall
COUNTY ENGINEER

D. O. Marshall
COUNTY ENGINEER

SHEET 1 OF 3 SHEETS BRIDGE NO. 52-05



NOTES:
SHOWS NOTES ADDED BY HETCALF & EDDY, INC., FIELD SURVEY AUG. 23, 1978.
DRAWINGS SHOWN ARE NO LONGER TO SCALE.

TOWN OR CITY *Upton*

DECREE NO.

PLAN NO.

DAM NO. *303* ~~52~~ - 05.LOCATION *Center - Grist Mill - Owned by M.D.P.W.*

C. C. DOCKET NO.

DESCRIPTION OF DAM
Type *Spillway - Stone passage under*
State Hy. Embankment - El. 100

Length

Height *12'*

Thickness top

" bottom

Downstream Slope

Upstream "

Length of Spillway *cr. 97' El. top 97.0*

Size of Gates

Location of Gates

Flashboards used

Width Flashboards or Gates

Dam designed by

" constructed by

Year constructed

GENERAL REMARKS

Owner: *L. A. Snow. H.C. 1937 - H.C. Snow*Inspected: *April 22, 1925 - L.O. Marden*

Nov. 1, 1926

Sept. 7, 1927

Nov. 30, 1929

1937 - Owner *M. J. H. 1934 Snow*" *Oct. 20, 1938 - K. M. Finlayson*

OWNER - TOWN OF UPTON ? check if M.D.P.W. owned.

DESCRIPTION OF RESERVOIR & WATERSHED

Name of Main Stream *From Pratt Pond*

" " any other Streams

Length of Watershed

Width " "

Is Watershed Cultivated

Percent in Forests

Steepness of Slope

Kind of Soil

No. of Acres in Watershed

" " " " Reservoir

Length of Reservoir

Width " "

Max Flow Cu. Ft. per Sec.

Head or Flashboards - Low Water

" " " " High "

GENERAL REMARKS

Use: *Grist Mill*Inspected: *Nov. 14, 1946 - L.O.M. W.O.L.*Aug. 9, 1950 " *P.E. Casey*

Nov. 3, " "

Nov. 8, 1951 - *L.O.M. Blake**G. Crockett & H. Poirier*INSPECTED - 1/12/72 - *V.F.P. & R.N.*

2 - Library Bureau 10-92260

PREVIOUS INSPECTIONS (PARTIAL LISTING)

COPY OF INSPECTION CARD ON FILE AT THE MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS, DISTRICT OFFICE, WORCESTER.

INSPECTION REPORT & DATA FOR DAMS

Owner: TOWN OF UPTON SELECTMAN
 His Address: _____
 Function of Dam: OLD MILL POND

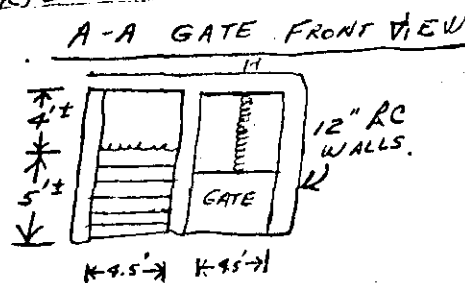
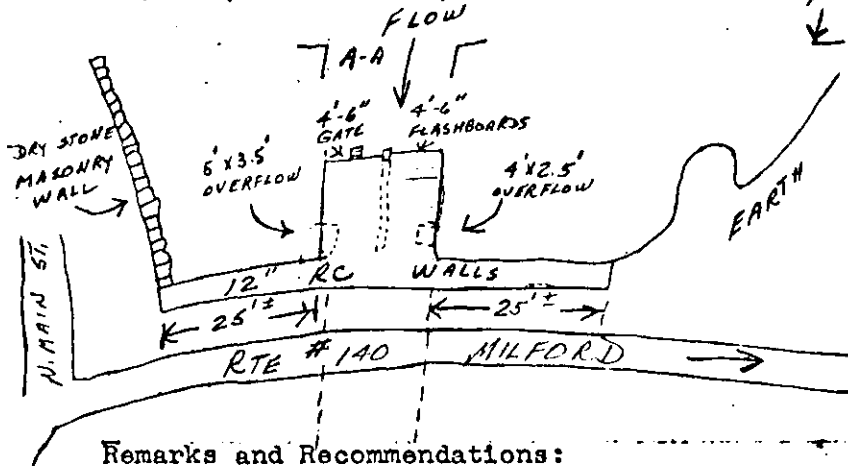
Location & Access: Upton Center - Jct N. MAIN ST + RTE #140.

USGS Quad. Milford Lat. 42°10'25" Long. 71°36'10"
 Drain. Ar. 4.00 Sq. Mi. Ponds: ac.; Res. @ dam: _____
 Character of D.A.: _____

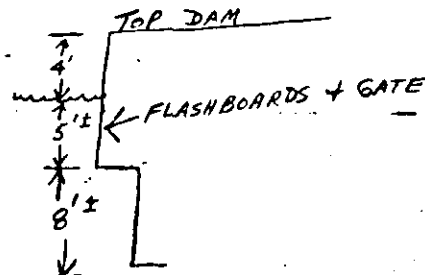
Estimated
 Discharge: _____
 Capacity: _____

General Description of Dam and Discharge Control:

12" R.C. RETAINING WALLS W/ RTE #140 - 4' HIGHER THAN
TOP OF RETAINING WALLS
FLASHBOARDS 4" X 12" X 4'-6" IN GOOD CONDITION
12' X 12' CULVERT RUNNING UNDER 140. RTE #140
 Sketch (Not to Scale):



A-A SIDE VIEW



Remarks and Recommendations: _____

Date

1/12/72

By

VFP
RH

Comment

(M)

Dam No. 52-05

Town: UPTON

Stream: CENTER BROOK

Pond: OLD GRIST MILL POND

Date: 1/12/72

By:

CONDITION RATING

Structural: GOOD

Hydraulic: 9' x 9'

General: GOOD

PRIORITY: NONE

3-14-303-05

Dam No. 52-05

APPENDIX C
PHOTOGRAPHS

OLD GRIST MILL POND DAM



**NO. 1 VIEW OF SPILLWAY
AND OUTLET STRUCTURE**



**NO. 2 VIEW OF STREAM BED
BELOW DAM**



**NO. 3 VIEW OF DOWNSTREAM FACE OF DAM AND
BOX CULVERT**



**NO. 4 VIEW OF WALLS OF BOX CULVERT
AND DOWNSTREAM SIDE
OF SPILLWAY/OUTLET STRUCTURE**



**NO. 5 CLOSE-UP OF DOWNSTREAM SIDE OF
SPILLWAY ON RIGHT AND CONCRETE
HEADWALL ABOVE OUTLET ON LEFT**



**NO. 6 CLOSE-UP OF WOODEN SLIDE
GATE FOR OUTLET CONTROL**

APPENDIX D
HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

OLD GRIST MILL POND DAM

I Test Flood, 100 year storm & Storage Functions

1- Total Drainage Area - 4.14 mi²

2- Ponds & Swamps - { Ponds: 0.091 mi²
 Swamps: 0.227
 0.318 }

$$\% \text{ Ponds \& Swamps} = \frac{0.318}{4.14} = 7.7\%$$

3- $\frac{595-290}{500} = 4.6\%$
 $\frac{562-290}{1430} = 1.9\%$ } Say Ave Slope = 3%

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be somewhat lower than "Rolling"; and taken at 1600 c.f.s./mi²

Due to low dam height use $\frac{1}{2}$ MPF

5- Test Flood Inflow = $\frac{1}{2}(1600) 4.14 = 3312 \text{ c.f.s.}$

6- Storage

The pond has an area of 0.014 mi². Just upstream, Pratt Pond has an area of 0.064 mi². A one foot rise on Old Grist Mill Pond equals 9.0 acre feet of storage. Were both ponds to rise at the same rate the storage would be 50 acre feet per foot.

7- Storage Functions are based on $Q_{out} = Q_{in} [1 - \frac{S_{out}}{R}]$

S_{out} = Storage Vol. in Reservoir related to final Q_{out} in terms of inches of rain over the drainage area.

$$S(\text{in inches}) = 12 D \left(\frac{0.014}{4.14} \right) = .0406 D; R = 6 \text{ hr rain of } 1 \text{ in}$$

D = Storage Depth (above spillway) on reservoir, in feet

8- Storage Functions: (F_T) ; $D = 0.47 \text{ w.s. @ E.I. } 293.6$

$$F_T = 3312 - 348.6 S = 3312 - 14.1 D$$

① Continued

9- Old Grist Mill Pond is only slightly lower than Pratt Pond just upstream. Use total area of both ponds to define storage functions, since volume must be stored in both to permit higher discharge:

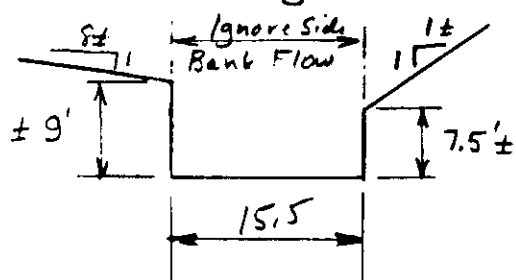
$$S' = 12 D \left(\frac{0.014 + 0.004}{4.14} \right) = 0.226 D \quad \checkmark$$

Modified Storage Functions:

$F'_{TF} = 3312 - 78.8 D$	$(D = 0.7 \text{ W.S. 2.5' 10" 1/2})$
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II Downstream Depth vs Q Relations

A - Discharge Channel



Bot. Slope (under high flow) taken from
USGS Map:

$$S = \frac{10' \text{ Drop}}{700' \text{ Length}} = .0143; \sqrt{S} = 0.12$$

$$n = .025; V = 7 R^{2/3}$$

y	A	P	$R^{2/3}$	V	Q
4	62	23.5	1.9	13.4	829
6	93	27.5	2.25	15.8	1467
8	124	31.5	2.49	17.5	2164
10	155	35.5	2.67	18.7	2898
12	186	39.5	2.81	19.7	3657
14	217	43.5	2.92	20.4	4435

B - Dam Discharge Conduit

Conduit 10' wide x 16' high, 80' long, drop of 0.45'
 Assume high flows will clean out sediment - $n = 0.013$

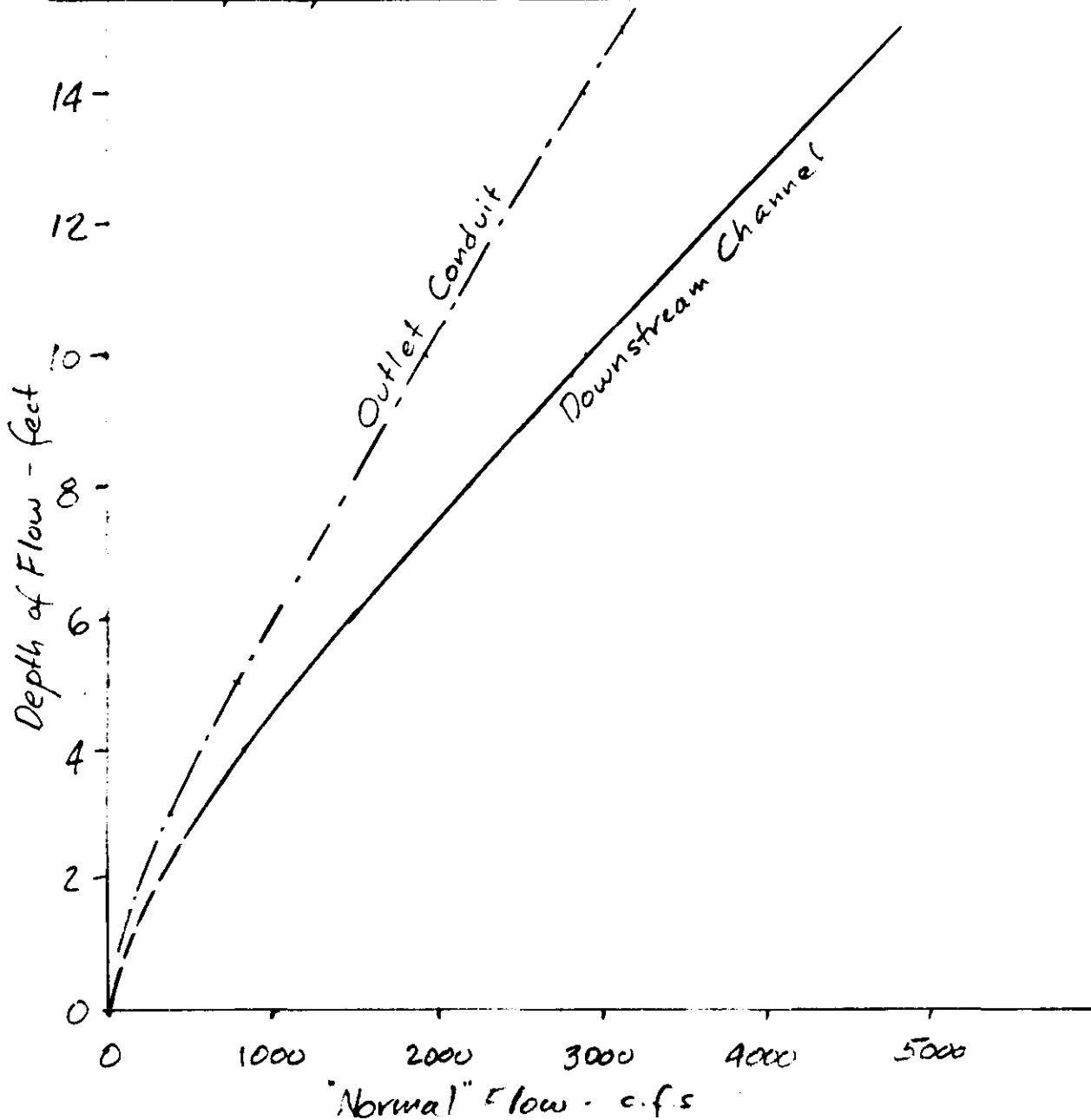
$$S = \frac{.45}{80} = .005625; \sqrt{S} = .075; V = 8.6 R^{2/3}$$

y	A	P	$R^{2/3}$	V	Q
3	30	16	1.52	13.1	392
5	50	20	1.84	15.8	792
10	100	30	2.23	19.2	1920
14	140	38	2.38	20.5	2870
15	150	40	2.41	20.8	3112
16	160	52	2.12	18.2	2910

Note: For similar depths the Channel carries a larger P
 than the conduit. Conduit is not affected by
 channel backwater
 Use conduit levels to calc. low level gate discharge
 Actual conduit levels probably lower.

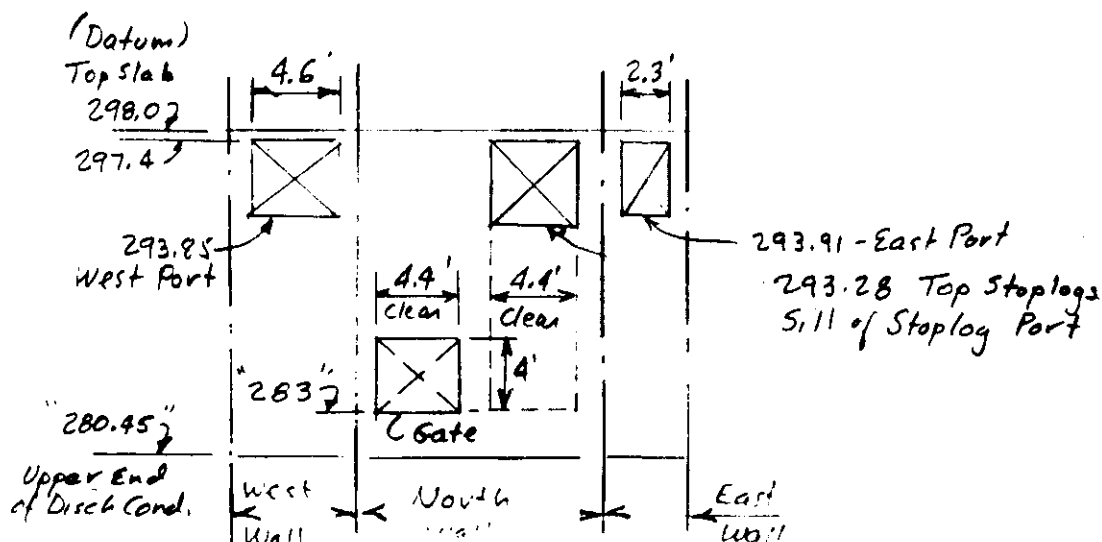
II Cont.

C - Plot of Depth vs Disch. - Downstr. Channel & Conduit



III Dam Discharge Rating

Discharge from dam is controlled by a rect. corr. box - as developed below



A- Ave Sill Elev. of 3 Ports:

$$\text{Ave Elevation} = \frac{3.85(4.6) + 3.91(2.3) + 3.28(4.4)}{4.6 + 2.3 + 4.4} = \frac{41.135}{11.3} = 3.64 = \text{Elev. } 293.6$$

$$\text{Ave H.} = 297.4 - 293.6 = 3.8'$$

B- Port Discharge [Ref. "Hydraulic Tables" Williams & Hazen - p=10']

Total length = 11.3', 6 Side Contractions @ 0.2' each; Net L = 10.0' ±

Water Elev.	294.6	295.6	296.6	297.6	298.6	299.6	300.6	301.6
Depth (ft)	1	2	3	4	5	6	7	8
(Total) Q (cfs)	33	94	175	273	387	516	650	794

C- Gate Disch. [Ref. "Open Channel Hydr." V.T. Chow, pg 498 Fig 17-29]

Note: H reduced to reflect water level in tunnel or discharge channel, when in control

Water El.	294.6	295.6	296.6	297.6	298.6	299.6	300.6	301.6	302.6	303.6
H	11.6-0'	12.6-0'	13.6-0'	14.6-0'	15.6-0'	16.6-0'	17.6-1'	18.6-2'	19.6-2'	20.6-4'
H/O	2.9	3.15	3.4	3.65	3.9	4.15	4.4	4.15	4.4	4.15
g	58	61	64	66	69	72	72	72	75	72
Q	255	268	282	290	304	317	317	317	330	317
W.S. -	304.6-6'	305.6-8'	306.1-9'							
H E -	15.6/3.9	14.4/3.65	14.1/3.52							
Q E -	69/304	66/290	65/286							

III Dam Discharge Rating (Cont.)

D- Submerged Port Disch. [Ref. - Same as for Gate Disch.]

Note: Use Total Width = 11.3'

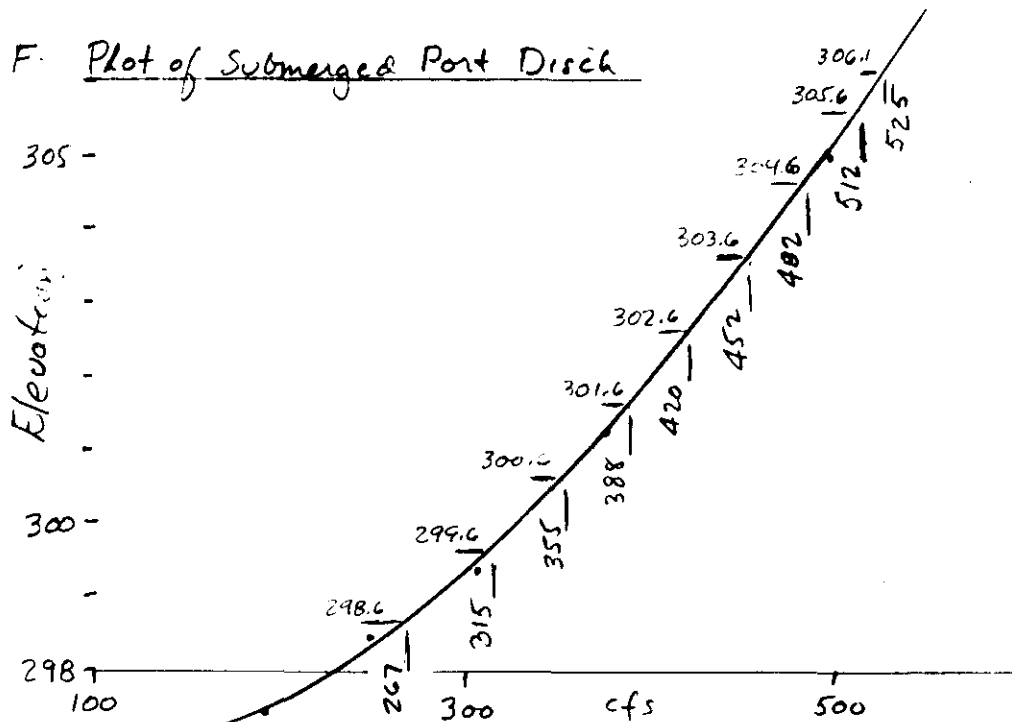
Water El.	297.4	298.4	299.3	301.2	305.0	308.8
H	3.8	4.8		7.6	11.4	15.2
H/D	1.0	1.25	1.5	2.0	3.0	4.0
Q	17	22	27	33	44	50
Q	192	248	305	373	497	565

E- Over Crest Flow

Use $Q = 2.55 (H)^{1.5}$ [Ref. "Open Chan. Hyd" V.T.C. 1, pp. 2-10]
 Effective Crest length $\approx 100'$, due to buildings
 Crest is upstr. sidewalk @ Elev. 301.2±

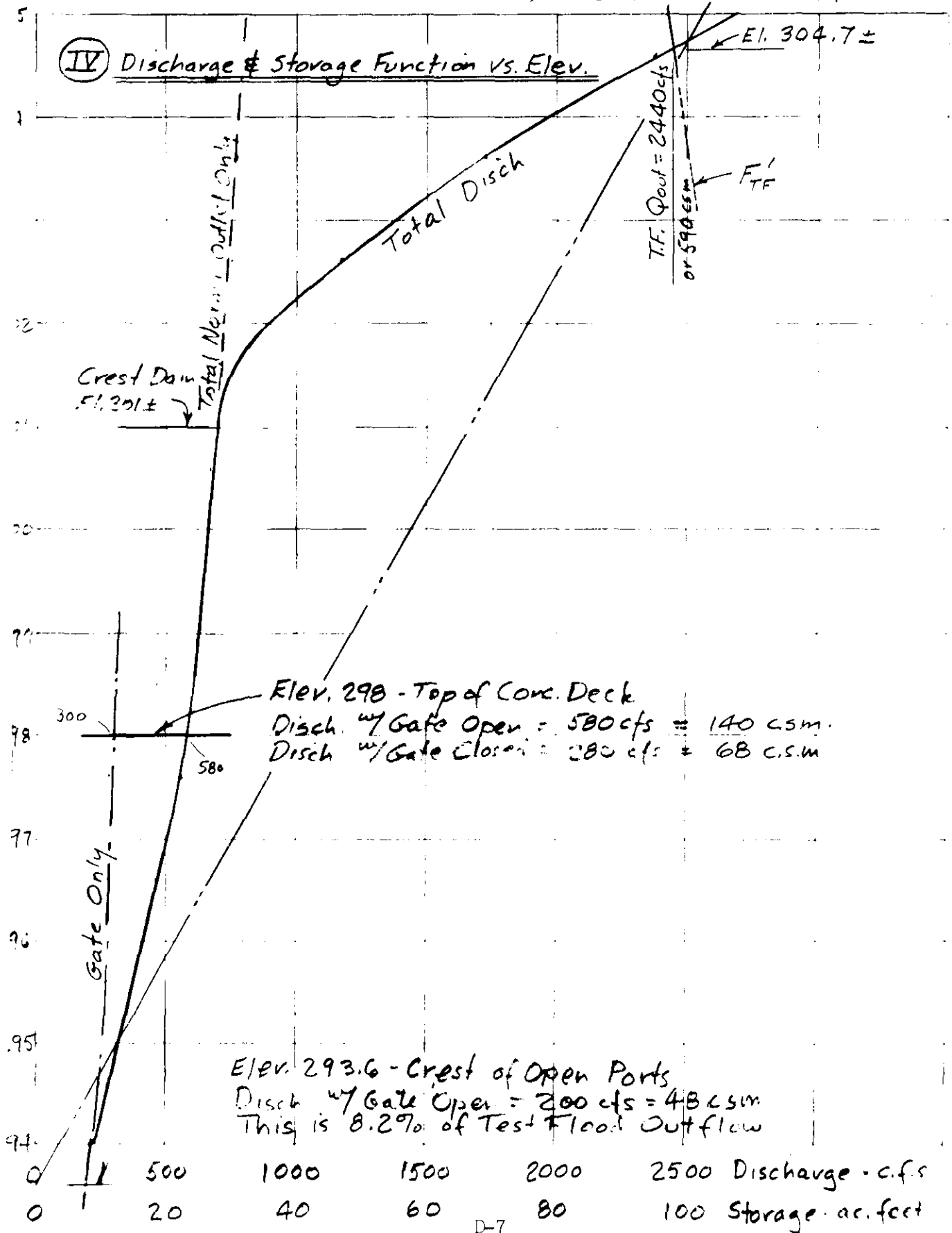
Water El.	301.6	302.6	303.6	304.1	304.6	305.1	305.6	306.1
H	0.4	1.4	2.4	2.9	3.4	3.9	4.4	4.9
Q	64	422	948	1259	1600	1960	2350	2760

F. Plot of Submerged Port Disch



G- Summary of Discharges

Water El.	294.6	296.6	297.6	298.6	300.6	301.6	302.6	303.6	304.6	305.6	306.1
Gate	255	282	290	304	317	317	330	317	304	290	286
Port (Min)	33	175	273	304	355	388	420	452	481	512	525
Crest	—	—	—	—	—	64	422	948	1600	2350	2760
→ Total	288	457	563	608	672	769	1172	1717	2386	3152	3571
Add 2nd Gate	255	282	290	304	317	317	330	317	304	290	286
Total	543	749	853	912	989	1086	1502	2034	2690	3442	3857



⑤ Flow Over Crest

A. Test Flood - Peak Disch - 2440 cfs.
 Outlet " - 800 "

Crest Disch. - 1640

For 100' ± length of "Crest", $q = 16.4 \text{ cfs/ft}$

$$\text{Critical Depth} = y_c = \frac{16.4^{2/3}}{32.2^{1/3}} = \underline{2.0'}$$

$$\text{Critical Velocity} = V_c = 16.4 \div 2 = \underline{8.2 \text{ fps}}$$

⑥ Peak Dam Failure Flows

A - Peak Test Flood Head: w.s. 298.0 ±
 Top El. - 280.0

$$18.0 = Y_0$$

$$\text{Width} = 43'; W_0 = 0.4(43) = 17.2'$$

$$Q_p = 1.68(17.2)(18)^{1.5} = 2200 - \text{Depth in Channel } 8' \pm$$

$$Q_1 = 2200 + 580 \approx 2800 \text{ cfs} - \text{Depth in Channel } 9.8'$$

B - Pond Vol. - Above Open Ports: [from Graph]: = 67 ac. ft.

$$\text{Below " " : } \frac{1}{3}(10.6)(640)(.014) = \underline{32} "$$

$$\text{Total } \underline{99} "$$

C - Time to Drain:

$$\frac{(99 \times 43560)}{\frac{1}{2}(2780)(3600)} = 0.86 \text{ hr or } 52 \text{ min.}$$

Note: No attenuation of peak dam break discharges made here due to minimal channel length between dam and local residences.

Rise in discharge channel: 1.8' due to failure.

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

OLD GRIST MILL POND DAM